CLAIMS

WHAT IS CLAIMED IS:

1. An optical amplifier comprising:

a device substrate;

a first waveguide embedded in the device substrate; and

a first plurality of lasers positioned to provide a first plurality of light beams substantially transverse to the first waveguide.

2. The optical amplifier of claim 1 wherein each of the first plurality of lasers are spaced apart from one another along a length of the first waveguide.

3. The optical amplifier of claim 2 wherein the first plurality of lasers are vertical cavity surface emitting lasers.

4. The optical amplifier of claim 3 wherein the first plurality of lasers share a common substrate.

5. The optical amplifier of claim 4 wherein the vertical cavity surface emitting lasers are bonded to the device substrate.

6. The optical amplifier of claim 1 wherein the device substrate is a phosphate glass doped with Erbium.

7. The optical amplifier of claim 1 further comprising:

a second waveguide embedded in the device substrate; and

a second plurality of lasers positioned to provide a second plurality of light beams substantially transverse to the second waveguide.

8. The optical amplifier of claim 1, wherein the first plurality of lasers are evenly spaced apart from one another.

9. A method of amplifying an optical signal comprising:

directing the optical signal through a waveguide, the optical signal having a first direction of propagation; and

applying a plurality of light beams substantially transverse to the first direction of propagation.

10. The method of claim 9, wherein the plurality of light beams is provided by a plurality of laser diodes.

11. The method of claim 10, wherein the optical signal has a wavelength of approximately 1550 nm, and the plurality of light beams has a wavelength of approximately 980 nm.

12. The method of claim 11, wherein the applying the plurality of light beams further comprises:

using a plurality of lasers each using less than 50 mW of power.

13. The method of claim 11, wherein the applying the plurality of light beams further comprises:

using a plurality of lasers each using less than 20 mW of power.

14. The method of claim 9 further comprising:

reflecting the plurality of light beams back at the waveguide after passing through the waveguide.

15. A method of making an optical signal amplifier comprising:

attaching a plurality of light sources to a surface of a substrate, the substrate having a waveguide embedded within, wherein the plurality of light sources are directed substantially transverse to the waveguide.

16. The method of claim 15, wherein the attaching of the plurality of light sources comprises:

bonding a plurality of vertical cavity surface emitting lasers to the surface of the substrate.

17. The method of claim 16, wherein each of the plurality of vertical cavity surface emitting lasers is spaced apart in a line on a common semiconductor substrate.

18. The method of claim 16, wherein each of the plurality of vertical cavity surface emitting lasers is spaced apart by a constant distance.

19. The method of claim 16, wherein the plurality of vertical cavity surface emitting lasers each operate at less than 50 mW.

20. The method of claim 16, wherein the plurality of vertical cavity surface emitting lasers each operate at less than 20 mW.

21. An optical amplifier comprising:

a substrate;

a waveguide embedded within the substrate, the waveguide having a primary direction of propagation;

an array of lasers positioned to provide a plurality of pumped light beams transverse to the primary direction of propagation.

22. The optical amplifier of claim 21, wherein at least one of the array of lasers operates at less than 20 mW of power.